Sanitary Survey Report

Hopi Cultural Center Public Water System
PWSID # 0400260

Survey Conducted for the
Environmental Protection Agency
Region 9

March 14 and 19, 2018

Sanitary Survey Conducted
by

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for

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A. Introduction

On March 14 and 19, 2018, Dan Fraser, P.E., and JanDee May, of Sleeping Giant Environmental Consultants, LLP (SGEC), conducted a sanitary survey of the Hopi Cultural Center Public Water System (PWS). SGEC is an independent contractor that performs sanitary surveys for the U.S. Environmental Protection Agency's Region 9 (EPA Region 9). SGEC was assisted during the sanitary survey by:

- George Silas, Water Operator, Facilities/Risk Management Services, Hopi Tribe
- Phillip Onsae, Building and Maintenance Supervisor, Facilities/Risk Management Services/ Hopi Tribe
- Alexandra Litofsky, Field Engineer, Indian Health Service (IHS)
- Brett Gleitsmann, Circuit Rider, Rural Community Assistance Corporation

On March 21, 2018, SGEC returned to review the PWS's facilities with George Silas and Emmanuelle Rapicavoli, P.E., the EPA Region 9 program manager.

EPA Region 9 implements the Safe Drinking Water Act and regulations regarding public water systems[1] as they apply to most of the PWSs on Tribal lands in Region 9. Sanitary surveys of PWSs are an important component of EPA Region 9's direct implementation program and are critical for protecting the health of water users. They are comprehensive evaluations of a PWS's above-ground facilities, management and operation. During the sanitary survey, above-ground facilities are inspected, records are obtained and reviewed, and operators and managers are interviewed. PWS components evaluated include:

1. source(s)
2. treatment
3. storage
4. pumping facilities
5. operator compliance with training and certification requirements
6. management and operations
7. distribution system (including cross-connection control)

[1] *40 CFR Part 141 – National Primary Drinking Water Regulations*

8. monitoring, reporting and data verification (This component of the sanitary survey is addressed by SGEC only superficially as it is an area handled by the EPA Region 9 program manager.)

The purpose of the sanitary survey is to determine if the PWS's facilities and its operation and management provide consumers with adequate protection from waterborne pathogens and other contaminants. If deficiencies in public health protection are identified, SGEC provides recommendations for corrective actions.

B. Description of the System

The Hopi Cultural Center is located approximately 57 miles east of Tuba City on Highway 264 and includes a restaurant, hotel and an arts and crafts building. The Hopi Cultural Center PWS facilities are located about 100 yards northeast of the Cultural Center. There are two service connections, one serves the restaurant and the other serves the hotel and the arts and crafts building.

The Cultural Center employs roughly 25 people during the off-season and the arts and craft shop has one employee. The number of employees increases during the summer tourist season. Visitors to the Cultural Center approximate 200 people per day during the winter and doubles to an average of 400 people per day in the summer months. This PWS is classified as a non-transient non-community system because it regularly serves more than 25 of the same people for more than six months of each year. As a non-transient non-community PWS, it is regulated for both acute (having health effects over the short term) and chronic (having health effects when consumed over the long term) contaminants.

All the PWS's above ground facilities are within the same enclosed compound. The well, an air/water interface hydropneumatic tank and the pumping facility are within the same building. Since the last sanitary survey, arsenic treatment and full-time chlorination have been added in the same building. A separate room houses the chlorination facilities. Disinfection is the only active treatment because there have been problems getting the arsenic removal treatment facilities put online.

A 40,000-gallon ground level tank is located a few feet from the building. The distribution system is pressurized by the booster pumping facility that takes suction from the storage tank. The hydropneumatic tank controls the cycling of the pumps.

George Silas is the primary water operator and is responsible for the operation and maintenance of the PWS. Mitchell Sockwyma is the backup operator. George and Mitchell are employed by the Hopi Tribe. George is also the primary water operator for the Veterans Center PWS and Mitchell provides backup for him on that PWS too.

Following is a more detailed description of the water system components. Deficiencies and recommendations are numbered in order of their priority at the end of the narrative. The sanitary survey form in Section II contains more detailed information on the facilities, copies of documents provided by the PWS are included in Section III and photographs of the system are in Section IV of the report.

C. Sources

EPA Region 9 reports that the PWS's single well exceeds the maximum contaminant level for arsenic. Over the long term, the Hopi Tribe may abandon the well and tie this system to the regional water system.

GW001/Well 1 – Photos 2-4 and 13: The PWS operates a single ground water well. GW001 is housed within a locked building and shares the premises with an air/water interface hydropneumatic tank, treatment facilities and the pumping facility. GW001 was drilled in 1969 to a depth of 1,600 feet. It is cased to 1,430 feet with 8-inch diameter steel casing and sand packed from 1,430 – 1,600 feet with 20 – 40 mesh sand. It has twelve sections of five-feet long stainless-steel screen. The static water level was recorded at 863 feet and the 20-horsepower (hp) pump was set at 1,000 feet. The pump reportedly produces 34 gallons per minute but did not run while the evaluators were on site. The operator keeps records of water production and chlorine residuals (Photo 15).

The operator reported that the well is pumping air and it is thought this problem is caused by a corroded drop pipe. The theory is that, when the well pump shuts off, water will leak out of the drop pipe through one or more holes caused by corrosion. Then, when the pump starts, the air in the drop pipe is forced out as it is replaced by pumped water.

The well is equipped with a sandwich-type sanitary seal that has an inverted U-type vent that is screened (Photos 3-4). Electrical wires are protected by conduit. The discharge line has a master meter and the well pumps directly through the treatment plant and into the storage tank. Currently, only the disinfection portion of the treatment is in service.

The building that houses the facilities is spotlessly clean and well organized. The chlorination facilities are in a separate room which should help reduce corrosion.

All the PWS facilities are within the same fenced and locked enclosure. The area is relatively free of clutter and debris though some pipe and miscellaneous materials are stored in the back of the compound.

Deficiencies:

- The well is pumping air. This is thought to be caused by corrosion of the drop pipe that allows water to leak out when the submersible pump is not running.

D. Treatment

TP001/Chlorination and Arsenic Removal – Photos 2, 5-7 and 12: Since the last sanitary survey, treatment facilities have been added and are housed in the same building as the well, pumping facility and the hydropneumatic tank. The treatment facilities include disinfection using sodium hypochlorite solution diluted to less than two percent and arsenic removal by adsorption using a proprietary ISOLUX system.

The treatment plant is designed so that water from the well is first filtered by a bag filter assembly, then booster pumped through the ISOLUX cannister containing zirconium cartridges (Photos 6, 7 and 12). The arsenic removal facilities can be bypassed by all, or a portion, of the well water. After the treated water and bypassed water come together, chlorine is injected. SGEC believes that the chlorine should be injected ahead of the arsenic removal facilities to ensure oxidization of the dissolved arsenic.

Chlorine is currently being injected for disinfection; however, the ISOLUX facilities have yet to be put into service. Therefore, the PWS likely remains in non-compliance with the maximum contaminant level (MCL) for arsenic. Reportedly, the well is pumping air and the air caused problems with the arsenic treatment facilities. Therefore, the arsenic adsorption facilities are being bypassed until the air problem can be diagnosed and corrected. As noted above, the operator believes that there is a hole in the well's drop pipe causing loss of water when the pump is off and a surge of air when it restarts. This seems to make sense and is relatively easy to correct, but not necessarily inexpensive.

A separate room that was under construction during the last sanitary survey now houses the chlorination facilities, isolating the chlorine solution to reduce the potential for corrosion (Photo 5). A chlorine day tank holds the sodium hypochlorite solution that is approved by the National Sanitation Foundation (NSF). There is secondary containment but no emergency eye wash station.

Deficiencies:

- There is no emergency eye wash station.
- Arsenic treatment is not online and the PWS is not in compliance with the arsenic MCL.
- Assuming corrosion has caused one or more holes in the drop pipe, postponing repairs could lead to loss of the submersible pump and the drop pipe as corrosion worsens.
- Chlorine should be injected ahead of the arsenic removal facilities.

E. Finished Water Storage

ST001/Storage Tank 1 – Photos 2 and 8-11: The tag on the storage tank says the tank was constructed in 1970 with a 40,000-gallon capacity. ST001 is supported by what appears to be a concrete ring foundation. The overflow is a stubbed pipe near the top of the tank that is screened (Photo 8). There is no splash pad below the overflow pipe but there is no sign of erosion. The hatch is a bolted-down, flanged device that does not meet current design standards for potable water storage tanks (Photo 9). Consequently, the inside of the tank could not be inspected. The vent is too small and a portion of it has broken off leaving the interior of the tank vulnerable to birds, insects and dust (Photo 10).

The tank is 40 feet in height and its full access ladder does not have a safety cage with locking gate, a secondary landing, a safety cable or safety railings at the top. Thus, as pointed out in previous sanitary surveys and the 2003 tank inspection, it is a safety hazard to the operator (Photo 8). The ladder is not locked or secured in any way to discourage access by unauthorized individuals. The target is not operational.

The tank was cleaned in September 2016. During the inspection, it was found that the walls from top to bottom were blistered, there was corrosion at the seals and there were patches on the tank's floor. The tank does not have an internal ladder. The cleaning process apparently dislodged one of the patches causing the tank to leak and eventually drain. The contractor returned and fixed the leak and the operator made provisions to drain the leaked water away from the base of the tank (Photo 11). The tank inspection report is included in the appendix found in Section III of this sanitary survey report.

The well pumps directly to the storage tank through a dedicated fill line. The booster pumps take suction from a dedicated line near the bottom of the tank to pressurize the distribution system.

Deficiencies:

- The ladder is a safety hazard to operators.
- The ladder has no provisions to deter unauthorized access.
- The tank has no functional target.
- The internal and external condition of the tank is very poor (see the inspection report in Section III of this report).
- The interior coating appears to be a coal tar material that is not certified for use with potable water.
- The roof hatch needs to be replaced with a hatch that meets design standards for potable water tanks.
- The vent is too small and a portion of it has broken off leaving the interior of the tank vulnerable to birds, insects and dust.

F. Pumps, Pumping Facilities and Controls

As noted above, the well pumps directly to the ground level storage tank. The system is then pressurized by a duplex booster pumping facility that takes suction from the storage tank and pumps through an air-water interface hydropneumatic tank to the distribution system. The well pump is started manually, and the booster pumps are controlled by a pressure switch.

PF001 and HP001/Booster Pumping Facility and Hydropneumatic Tank – Photos 2 and 12-14: These facilities are in the building that houses the well and treatment plant. PF001 consists of two 3-hp pumps configured in parallel (Photo 12). They take suction from the storage tank (ST001) and provide water and pressure to the distribution system. The two pumps are started and stopped by a mercury pressure switch (Photo 12) located on top of the 4-foot diameter air/water interface hydropneumatic tank (HP001). The two pumps alternate lead and lag positions.

The hydropneumatic tank reportedly maintains the distribution system pressure between 30 and 50 pounds per square inch (psi) and limits the cycling of the booster pumps. The sight glass was completely full of water indicating the hydropneumatic tank is waterlogged. A Nu-Matic Control Device manufactured by the Nu-Matic Company located in Alhambra, California, is supposed to maintain the appropriate amount of air in the hydropneumatic tank. However, it no longer works, and the operator must introduce air with a portable air compressor.

The hydropneumatic tank was, per its tag, constructed in 1970, so is nearly 50 years old. There is no evidence that it has ever been inspected or rehabilitated. From the outside, it appears to be sound but there may be corrosion of the tank's interior. Because of the compressed air, catastrophic failure of the hydropneumatic tank would be an explosive event that could injure or kill anyone nearby. Exacerbating the risk is the lack of a pressure relief valve (PRV). While the tank is constantly under pressure with compressed air, the risk of catastrophic failure is increased by the absence of a PRV. A properly sized PRV will serve to limit the pressure the tank has to withstand should the well pump fail to turn off. The PRV should be sized to open at a level less than the hydropneumatic tank's maximum allowable working pressure and have the capability to handle the full pumpage rate at that pressure. The tank should be taken out of service and inspected by a competent tank rehabilitation company.

At the time of the 2015 sanitary survey, Facilities and Risk Management Services said they were in the process of securing funding and obtaining bids for installation of a new pre-engineered skid-mounted pumping facility with variable frequency drive. Such a facility would be a significant improvement, but funds are apparently not available.

Deficiencies:

- The tank should be taken out of service, inspected and, to the extent necessary, rehabilitated.

- The makeup air is not being introduced automatically and the tank was waterlogged at the time of the sanitary survey. This leads to frequent pump starts with short run times that could cause premature pump failure.
- The tank does not have a pressure relief valve. This increases the safety risk.

G. Monitoring, Reporting and Data Verification

The PWS has a current monitoring schedule and an approved sampling plan. SGEC was not provided a copy of the sampling plan.

Deficiencies:

- None that SGEC is aware of.

H. Distribution System

DS001/PWS# 0400260 Distribution System: The distribution system (DS001) is very limited and the system only serves two buildings. It is reported to be comprised of 4-inch diameter galvanized iron pipe (GIP) that splits into two 2-inch diameter GIP service lines. It is comprised of approximately 300 feet of pipe and is reported to be in good condition and free of leakage problems.

If repairs are needed, Facilities and Risk Management Services will make the repairs. They reportedly have standard operating procedures for repairs that include flushing and disinfection of the materials used and water lines repaired.

Deficiencies:

- None noted.

I. Management and Operation

The Hopi Cultural Center and its PWS are owned by the Hopi Tribe through the Hopi Tribal Enterprise Board. The enterprise has a five-member board of directors that reports to the Tribal Council. The board contracts with an independent entity for management of the Cultural Center's businesses. The contractor directly hires employees for the businesses. The corporation is not charged for water and it does not contribute to the on-going operational costs of the PWS or related capital improvements. It is unclear to SGEC how profits from the businesses are disbursed and who should be paying for PWS improvements. The ultimate responsible party is likely the Hopi Tribe.

The PWS is operated and maintained by the Tribe's Facilities and Risk Management Services. George Silas is the primary water operator and is responsible for the day to day operations and maintenance of the PWS. He is also responsible for the Veterans Center PWS. Mitchell Sockwyma is the backup operator for both PWSs. Edgar Shupla is the director of the Facilities & Risk Management Services and reports to the Hopi Tribal Council. Phillip Onsae is the building and maintenance supervisor and Steven Bahnimptewa is the small projects manager.

Deficiencies:

- The PWS has long-standing serious deficiencies that have not been corrected including:
  - The tank needs to be rehabilitated and brought up to current standards (or replaced).
  - Treatment for arsenic removal is in place but not in service.
  - The well reportedly needs to be pulled and the drop pipe replaced.
  - The hydropneumatic tank may present a serious safety threat to the operators.
  - The PWS is likely in violation of the MCL for arsenic.[2]

J. Operator Compliance with EPA Requirements

George Silas is certified at level one in treatment by the Inter Tribal Council of Arizona, Inc. George allowed his certification for distribution to lapse in 2017. He plans to recertify in distribution in April 2018. Mitchell Sockwyma is the backup operator. He is not certified but plans to take the certification tests in April 2018.

Deficiencies:

- Both operators should be certified in distribution and treatment.

K. Deficiencies and Recommendations

Following is a list of deficiencies and recommendations for the system based on information gathered during the sanitary survey. Each deficiency is ranked in order of severity and is assigned a **Health Risk Priority** number.

Deficiencies assigned a **Health Risk Priority 1** present a serious health risk. Health Risk Priority 1 deficiencies should be corrected immediately.

Deficiencies assigned a **Health Risk Priority 2** present a critical system defect, critical operational defect, or potential health hazard. Health Risk Priority 2 deficiencies should be corrected as soon as possible.

Deficiencies assigned a **Health Risk Priority 3** present a critical system defect, critical operational defect, or potential health hazard, but are not as significant as Health Risk Priority 2. Health Risk Priority 3 deficiencies should be corrected as workload allows.

Deficiencies assigned a **Health Risk Priority 4** present a system defect, operational defect, or potential contamination hazard and are costly to correct. Health Risk Priority 4 deficiencies should be addressed in any long-range water system improvement project.

[2] SGEC does not have the PWS's monitoring records to confirm this assumption.

Deficiencies assigned a **Health Risk Priority 0** are suggestions for improvement, but are not a health risk.

Deficiencies are identified by SGEC but final Health Risk Priority numbers are assigned by the EPA Region 9 program manager.

1. **Storage Tank Deficiencies (ST001 – ST1, ST2, ST4, M4 - Health Risk Priority 1) – Photos 8-11.** The storage tank has multiple deficiencies that present health risks to the water consumers and safety risks to the water operator. The deficiencies have been present for years and include the following:

    - The vent is undersized and not shielded from windblown dust and debris. It is also broken making the stored water vulnerable to contamination (Photo 10).
    - The tank has no water level target.
    - The interior coating of the tank is reportedly a coal-tar black mastic type of coating that is not NSF-approved and may be a health hazard.
    - The roof hatch needs to be replaced with a hatch that meets design standards for potable water tanks (Photo 9).
    - The tank's ladder is unsafe. It has no cage, safety cable, landing or safety rails at the top (Photo 8).
    - There are no provisions to keep unauthorized persons from climbing the tank if they gain access to the enclosure (i.e., safety cage for ladder and locked gate for cage) (Photo 8).
    - A recent inspection found multiple problems with the tank's condition. A copy of the inspection report is included in the appendix found in Section III of this report.

    These are significant problems and need to be corrected as soon as possible. They have been pointed out as deficiencies in multiple reports over the past several sanitary surveys. Due to long-term neglect, correction of the problems will likely be expensive.

    Recommendation: Immediate action should be taken to correct the deficiencies associated with the storage tank. EPA Region 9 should be provided with a schedule for all corrective actions. The broken vent should be screened immediately to keep birds and insects from contaminating the stored water.

2. **Arsenic Treatment (TP001 – M4, M5 – Health Risk Priority 1) – Photo 7.** The PWS has arsenic removal facilities installed but those facilities are being bypassed because the well is pumping air. Thus, the PWS is still in non-compliance with the MCL for arsenic.

Recommendation: The arsenic removal facilities should immediately be put into service.

3. **Hydropneumatic Tank (HP001 – M4 – Health Risk Priority 1) Photo 13.** According to the tag on its side, the hydropneumatic tank is 48 years old. Unless there is evidence that it has recently been examined and tested for structural soundness, it should be considered a safety risk. A large air/water interface hydropneumatic tank containing air compressed to more than 50 psi can be very dangerous in the event of a catastrophic failure.

   Exacerbating the risk outlined above is the fact that the hydropneumatic tank no longer has a pressure relief valve.

   Recommendation: A properly sized pressure relief valve should be installed immediately.

   The tank should be inspected as soon as possible and tested to document that it is structurally sound. If kept in service, it should be regularly inspected. Alternatively, the plan to replace PF001 and HP001 with a pre-engineered pumping facility could be pursued. A copy of the Joint Powers Insurance Authority's *Hydropneumatic Tank Inspection and Maintenance* recommendations is included in the appendix found in Section III of this report.

4. **Air Problems in Well Water (GW001 – M4, M5 – Health Risk Priority 1).** The well is thought to have problems with corrosion of the drop pipe that allows water to leak out when the pump is off. When the pump starts, it must purge the air into the discharge line which causes air-locking of the arsenic treatment vessels.

   If the above diagnosis of the cause of the air problem is correct, there is a possibility that the worsening corrosion could cause loss of the submersible pump and the drop pipe. Fishing those well components from the well would significantly increase the costs of corrective actions.

   Recommendation: The well should be inspected, and necessary repairs made.

5. **Operator Certification (O1 – Health Risk Priority 2).** The primary operator is certified in treatment but has let his distribution certification lapse. The backup operator is not certified.

   Recommendation: Both operators should be certified in treatment and distribution.

6. **Operator Safety (M3 – Health Risk Priority 3).** The treatment plant building does not have an emergency eyewash station.

   Recommendation: At a minimum, an emergency eyewash kit should be purchased and mounted in the chlorine room.

7. **Arsenic Treatment (TP001 – T2 – Health Risk Priority 0).** The treatment plant has chlorine being injected after the water has passed through the ISOLUX treatment facilities. Deep well water is likely to contain dissolved arsenic that has not been oxidized (arsenite). Oxidation with chlorine should convert the arsenite to arsenate which is negatively charged and easier to remove by adsorptive media.

   Recommendation: SGEC recommends that the point of chlorine injection be moved to ahead of the ISOLUX facilities to ensure oxidation of the dissolved arsenic.

L. Addendum to the March 14 and 19, 2018, Sanitary Survey Report

Since the time of the 2018 sanitary survey, SGEC has learned that the PWS is considering the following:

1. The treatment plant may be replumbed such that the well water will be pumped directly to the storage tank. Then, from the storage tank the water will be pumped through the treatment plant and into the distribution system. Reportedly, the replumbing is intended to allow degassing of the well water inside the storage tank thus alleviating the treatment plant's air-binding problem.

   SGEC recommends that the PWS contact the ISOLUX equipment supplier to make sure that the planned replumbing will be consistent with the design of the treatment facilities. The treatment plant is likely designed to be operated at a maximum of 34 gpm (the capacity of the well pump). Whereas, the twin booster pumps are designed to produce water at a rate that can meet the PWS's peak instantaneous demand. To operate the treatment plant at rates and pressures significantly higher than it was designed for could damage the media and/or produce water that does not meet regulatory requirements for arsenic.

2. Facilities may be added for the introduction of acid or carbon dioxide (CO_2), to increase the efficacy of the ISOLUX arsenic adsorptive media. While pH reduction will very likely increase the arsenic adsorptive capacity of the ISOLUX media, there are risks associated with it that need to be understood and addressed. For example, if pH control is lost due to equipment failure or by simply running out of the chemical (acid or CO_2), the media can "flush" previously adsorbed arsenic into the treated water and distribution system. During this event, the water will contain arsenic at concentrations higher than in the untreated water. Perhaps, at much higher concentrations.

II. Sanitary Survey Form

III. Appendix

d. Liquid Engineering Tank Inspection Report
e. ISOLUX Arsenic Removal Information
f. Association of California Water Agencies Joint Powers *SPLASH ALERT Hydropneumatic Tank Inspection and Maintenance*

IV. Photos